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IS 12874 (1989): Optical and Mathematical Instruments - Telescopic Alidade [PGD 22: Educational Instruments and Equipment]

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Indian Standard

OPTICAL AND MATHEMATICAL INSTRUMENTS — TELESCOPIC ALIDADE — SPECIFICATION

भारतीय मानक

प्रकाशित — गणितीय उपकरण — दूरदर्शी एलीडेड — विशिष्टि

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Optical and Mathematical Instruments Sectional Committee, LMD 20

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 6 December 1989, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Light Mechanical Engineering Division Council.

Telescopic alidade is an instrument used with a plane-table for large scale surveys. It provides a quick, easy and fairly accurate means of measurement of distances and heights with the help of a staff and thus plotting of the points on the plane-table. It is a robust, compact and easily handled instrument which combines, in one, an alidade, a tachometer and a plotting device to increase speed and efficiency in plane tabling.

This standard is intended chiefly to cover the technical provisions relating to telescopic alidade and it does not include all the necessary provisions of a contract.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

OPTICAL AND MATHEMATICAL INSTRUMENTS — TELESCOPIC ALIDADE — SPECIFICATION

1 SCOPE

1.1 This standard covers the requirements of telescopic alidade.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
988 : 1959	General requirements for optical components
1399 : 1959	Glossary of terms used in optical technology
1632 : 1960	Bubbles
2754 : 1964	General requirements of optical instruments
10236	Procedure for basic climatic and durability tests for optical instruments
(Part 2) : 1982	Part 2 Dry heat test
(Part 3) : 1982	Part 3 Cold test
(Part 11) : 1985	Part 11 Vibration test
(Part 14) : 1986	Part 14 Driving rain test

3. TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1399 : 1959, and the following definitions shall apply (*see also* Fig. 1).

3.1 Base Plate

Flat plate support attached at the base of the instrument. It rests on three point supports.

3.2 Swivel Screw

A screw fitted on the base plate to turn the instrument in azimuth for fine pointing to a target.

3.3 Plotting Arms

An arm, attached through links to the base plate, to form a parallel ruler.

3.4 Guide Rail

A rail fitted with the outer edge of the plotting arm to accommodate desired plotting scale.

3.5 Pricker

A mount carrying a sharp pin having spring action movement. This can be screwed into any of the interchangeable plotting scales at zero mark.

3.6 Column

A vertical arm fitted with the base plate. The top of this arm is fitted with the telescope carrying vertical circle.

3.7 Transverse Level

A spirit level fitted horizontally near the base of the column at right angles to the base plate.

3.8 Index Level

A spirit level fitted at the top of the column parallel to the base plate. This is also known as telescope level.

3.9 Plotting Scales

Interchangeable scales required for plotting horizontal distances, in metric system, from instrument to staff on scale ratios 1 : 100, 1 : 200, 1 : 250 and 1 : 500, etc.

3.10 Face Left/Right Position

The position of telescope depending on the vertical circle in left/right side of the observer.

4 GENERAL REQUIREMENTS

4.0 Each part of the alidade shall be made from materials of suitable strength and shall be suitably finished.

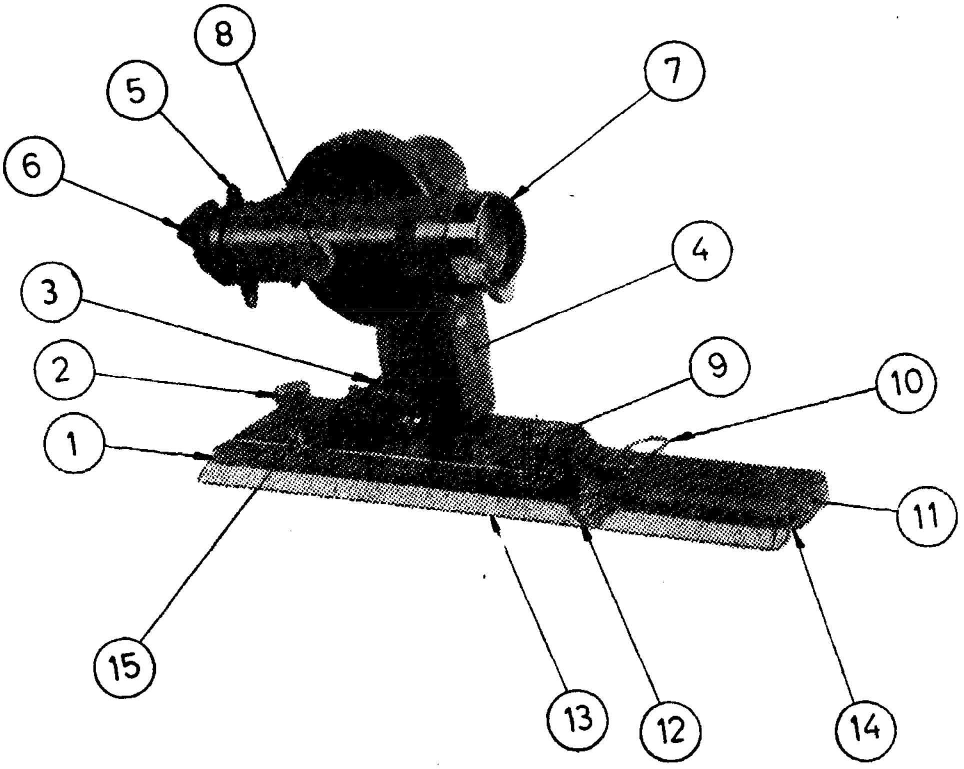
4.1 Base Plate

4.1.1 The instrument shall be provided with a sturdy and stable base plate resting on three points for minimum friction.

4.1.2 A circular spirit bubble shall be provided on the base plate.

4.1.3 A swivel screw shall also be provided in the base plate for slight movement of the instrument in the horizontal plane.

4.1.4 Provision shall be made for fitting a clamp to retain scale, as and when required, in its position by engaging the head of the pricker firmly.



1 — Parallel plotting arm
2 — Swivel screw, for pointing in azimuth
3 — Transverse level
4 — Telescope support column
5 — Open sight
6 — Telescope eyepiece
7 — Telescope objective
8 — Focussing knob
9 — Circular level on base plate
10 — Retaining clip
11 — Base plate
12 — Pricker
13 — Plotting scale (interchangeable)
14 — Guide rail for plotting scale interchangeable
15 — Stud for moving the plotting arm

FIG. 1 TELESCOPIC ALIDADE

4.2 Column

4.2.1 The column shall be fitted vertically on the base plate with provision of slight tilting in transverse (sideways) and forward and backward directions. The transit axis of the telescope and the vertical circle shall be supported by the top of the column.

4.2.2 Verticality of the column shall be ensured by centring the transverse and the index levels fitted near the bottom and the top of the column, respectively.

4.2.3 It shall also be provided with a slow motion screw for fine pointing of the telescope in azimuth (vertical plane).

4.3 Coating and plating on each part shall be durable to resist discoloration, wear and rust.

4.4 The optical parts shall conform to IS 988 : 1959.

4.5 The telescope shall be suitably sealed to avoid fungus growth.

4.6 The plotting arm shall have the same length as that of the base plate and shall be provided with lateral shift of about 35 mm. To move the arm, a knurled head knob shall be provided.

4.7 Transverse Level

The transverse level shall be provided with sensitivity of 2' per 2 mm run.

4.8 Index Level

An index level of sensitivity 60" (1') per 2·0 mm run shall be fitted near the top of the column, parallel to the base plate.

4.9 Circular Level

It shall be provided with sensitivity of 8' per 2·0 mm run.

4.10 All these spirit levels shall conform to IS 1632 : 1960.

4.11 Telescope

A telescope, giving erect image, shall be provided to rotate in vertical plane only. The general requirements of the telescope shall be as follows:

a) Magnification : 25×

b) Clear objective aperture : 40 mm

c) Field of view : 1·3°

d) Shortest focussing distance : 2·0 m

e) Multiplication constant for:

Face left distances	100
Face right distances	200
Height differences	± 25, ± 50, ± 100 (If three pairs of inclined middle curves are provided)

f) Additive constant : Practically zero.

4.12 Eye Piece

A rotatable diagonal eye piece, inclined at 45°, shall be provided with the telescope for comfortable viewing.

4.13 Dioptric scale shall be provided with the eye piece and shall have a range of ± 5 D.

4.14 Vertical Circle

A 360° glass arc vertical circle, with graduation interval of 10 minutes, shall be provided for reading vertical angles. The circle shall be enclosed and its readings shall be internally projected into the field of view of the telescope. It shall enable reading up to 1 minute by estimation. Each degree division shall be marked longer than the minute division.

4.15 Reducing Curves

The telescope shall be internally provided with reducing curves and their images shall be projected into the field of view of the telescope. These curves shall be upper curve, lower curve, vertical line and few inclined middle curves.

4.15.1 The following requirement of reducing curves shall be fulfilled, while using the alidade in face left position:

a) The lower line shall be zero curve used for measuring vertical angles, that is, on coinciding the point with lower line, the vertical angle of the point shall appear in the field of view.

b) The upper curve shall be the distance curve with a multiplication factor 100.

c) Together with the zero curve, the upper curve shall be capable of being used for measuring horizontal distance from a staff, that is, the staff intercept between the two curves multiplied by 100 will give the horizontal distance in metre even in the inclined position of the telescope.

d) Few middle curves shall be provided which shall be the height reading curves. These shall be marked with their respective constants, such as ± 25, ±50, ± 100, etc, for different inclinations of the telescope.

e) The elevation (+) and depression (—) shall be indicated with the constants of the inclined middle curves.

f) Together with the zero curve, these middle curves shall be capable of being used for measuring differences in heights, that is, the difference in height between the instrument and the point on staff cut by the zero (lower) curve shall be given by the product of the intercept on the staff between the height curve and the zero curve and the multiplication constant of the height curve.

4.15.2 The following requirements of reducing curves shall be fulfilled while using the instument in face right position which may be required at longer distances when the staff is not sufficient to be intersected by zero and distance curve simultaneously:

a) The upper curve shall now be zero curve used to measure vertical angles as explained at **4.15.1**(a);

b) The lower line shall now be the distance curve with a multiplication factor of 200, but it shall not be a reduction curve; and

c) The intercept on staff of these two curves multiplied with 200 shall give the inclined distance.

4.16 Slighting Vanes

Two slighting vanes shall be provided on the telescope.

4.17 Pricker

The pricker shall be made of suitable material and shall have provision to fit a sharp needle. The needle shall be provided with spring action and its tip shall have thickness of not more than 0·1 mm. The design of the pricker shall be such that it can fit to the mount of all scales.

4.18 Scales

4.18.1 The instrument shall be provided with interchangeable scales having different scale ratios, such as, 1 : 100, 1 : 200, etc.

4.18.2 The scales shall be capable of being accommodated along the plotting arm its groove.

4.18.3 Each scale shall be provided with a mount to firmly hold the pricker. The mount shall be fixed at zero position of scale which shall be at about 100 mm from the near end of the scale in face left position of instrument.

4.19 Case

The case shall be made of well seasoned wood, plastic or fibreglass, it shall be suitably cushioned from the inside to accommodate the instrument, scales, pricker and adjusting tools.

5 FUNCTIONAL REQUIREMENTS

5.1 The telescope shall conform to IS 2754 : 1964.

5.2 The movement of the telescope shall be certain and smooth.

5.3 The telescope shall have internal focussing mechanism which shall have smooth movement.

5.4 All the three bubbles shall be capable of adjustment by setting their screws.

5.5 The movement of the plotting arm shall be certain and smooth.

5.6 The movement of the whole instrument, in azimuth, with the help of the swivel screw shall be easy and smooth.

5.7 The scales shall smoothly slide along the rail.

5.8 The movement of the needle in the pricker shall be certain and smooth.

6 ACCESSORIES

6.1 The following essential accessories and tools shall be provided with each instrument:

a) Interchangeable plotting scales, metric, in ratios of 1 to 100, 200, 250 and 500, 4 Nos. (in a container).

b) Other items: Screw driver with 2 blades 1, adjusting pins 2, prickers—2, needles—6, needle holders in metal tube—2, mangifying glass—1, pencil file (sharpener)—1, and dusting brush—1 (in another container).

7 TESTS

7.1 The instrument shall be tested to comply with the requirements laid down in **3** and **4**.

7.2 The instrument shall be tested for improper fitting, missing components and damage or deterioration to various parts which shall not be allowed.

7.3 The telescope shall be tested to conform to IS 2754 : 1964.

7.4 After the instrument has been tested and adjusted in the manner prescribed in **7.1** to **7.3**, it shall be subjected to the following tests to ascertain the accuracy of the instrument:

a) *Distance Measurement Test*

A 200 m reasonably flat base line, established by steel tape (to which temperature and slope corrections have been applied) shall be measured with the telescopic alidade. The horizontal distance, so obtained, shall agree with the horizontal distance of base line within the minimum accuracy 1 : 100, that is the difference shall not be more than 200 mm.

b) *Height Measurement Test*

Heights of few known ground points shall be determined for sights less than 1 km. The difference in heights, thus obtained, shall be not more than 2 m.

7.5 Climatic and Environmental Tests

7.5.1 *Cold Test*

The instrument shall be subjected to cold test at temperature — 10°C for a period of 4 hours in accordance with IS 10236 (Part 3) : 1982. After the test, there shall not be any deterioration to any part of the instrument, namely, jamming of joints, deterioration of paint, etc. The instrument shall work well after the test.

7.5.2 *Dry Heat Test*

The instrument shall be subjected to dry heat test at temperature 55°C for a period of 16 hours in accordance with IS 10236 (Part 2) : 1982. There shall not be any deterioration to any part of the instrument after the test, namely, looseness of joints, deterioration of paint, etc. The instrument shall work well after the test.

7.5.3 *Rain Test*

The instrument shall be subjected to this test in accordance with IS 10236 (Part 14): 1986 at severity I (clause **6.1**). After the test, there shall not be any deterioration of any part, ingress of water deterioration to optical surfaces and paint, etc. The instrument shall work well after the test.

7.5.4 *Vibration Test*

The instrument shall be subjected to this test for frequency range of 5 to 50 Hz (clause **6.1.1**), displacement amplitude of 2·5 mm (Table 2) and duration of 3 hours (clause **6.1.3.2**) in accordance with IS 10236 (Part 11) : 1985 [*see also* Table 4, (i)]. After the test, there shall not be any deterioration to any part, namely, looseness of joints, breakage of components, etc. The instrument shall work well after the test.

NOTE — For defence use, severities will be specified by the purchaser/indentor.

8 MARKING

8.1 The instrument shall be marked with indication of the source of manufacture, name and the year of manufacture.

9 PACKING

9.1 The instrument and its accessories shall be placed in its case and suitably packed for transit, while packing, suitable cushioning materials shall be used to avoid damage during transportation.

Standard Mark

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